SDFCL s d fine-chem limited

CHLOROFORM

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

CHLOROFORM

OTHER NAMES

CHCl3, "formyl trichloride", "methane trichloride", trichloroform, trichloromethane, "trichloro methane", TCM, "cleaning solvent"

PROPER SHIPPING NAME

CHLOROFORM

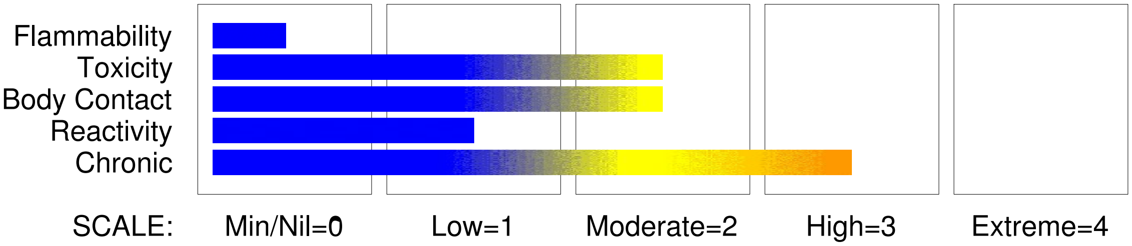
PRODUCT USE

As a solvent for fats, oils, rubber, alkaloids, waxes, gutta-percha and resins; as a cleaning agent; in fire extinguishers to lower the freezing temperature of carbon tetrachloride; in the rubber industry; as a solvent in organic chemistry. Laboratory reagent.
Medical use as anaesthetic discontinued because of toxicity.
Major use in modern industry is in the production of fluorocarbon-22, a refrigerant.

SUPPLIER

Company: S D FINE- CHEM LIMITED
Address:
315- 317, T.V. INDUSTRIAL ESTATE,
248, WORLI,
MUMBAI- 400030.INDIA.
technical@sdfine.com
Telephone: 91- 22- 24959898
Telephone: 91- 22- 24959899
Fax: 91- 22- 24937232

HAZARD RATINGS



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Section 2 - HAZARDS IDENTIFICATION

GHS Classification

Acute Toxicity (Dermal) Category 4
Acute Toxicity (Oral) Category 2
Carcinogen Category 1B
Eye Irritation Category 2B
Organ Damage Category 2
Reproductive Toxicity Category 1B
Respiratory Effects Category 3
Skin Corrosion/Irritation Category 2

EMERGENCY OVERVIEW

HAZARD

DANGER
Determined by using GHS criteria:
H336 H300 H312 H315 H320 H350 H360 H373
May cause drowsiness and dizziness
Fatal if swallowed
Harmful in contact with skin
Causes skin irritation
Causes eye irritation
May cause CANCER
May damage the unborn child
May cause damage to organs through prolonged or repeated exposure.

PRECAUTIONARY STATEMENTS

Prevention

Obtain special instructions before use.
Wash hands thoroughly after handling.
Wear protective gloves/clothing
Do not breathe dust/fume/gas/mist/vapours/spray.
Wash thoroughly after handling.
Do not handle until all safety precautions have been read and understood.
Use personal protective equipment as required.
Do not eat, drink or smoke when using this product.

Response

Wash contaminated clothing before reuse.
If exposed or concerned: Get medical attention advice.
If eye irritation persists, get medical advice/attention.

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If skin irritation occurs, seek medical advice/attention.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF ON SKIN: Gently wash with plenty of soap and water.
Get medical advice/attention if you feel unwell.
Specific treatment: refer to Label or MSDS.
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
Call a POISON CENTER or doctor/physician if you feel unwell.
Wash/Decontaminate removed clothing before reuse.
Remove/Take off immediately all contaminated clothing

Storage

Store locked up.

Disposal

Dispose of contents and container in accordance with relevant legislation.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
chloroform	67-66-3	>98
and either of (1) ethanol,		0.5-1 ^
or (2) amylene		0.025 ^
(stabilizer)		

Section 4 - FIRST AID MEASURES

SWALLOWED

Avoid giving milk or oils.
Avoid giving alcohol.
- For advice, contact a Poisons Information Centre or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Transport to hospital or doctor without delay.

EYE

If this product comes in contact with the eyes:
- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- If pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

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SKIN

If skin contact occurs:
· Immediately remove all contaminated clothing, including footwear.
· Flush skin and hair with running water (and soap if available).
· Seek medical attention in event of irritation.

INHALED

· If fumes or combustion products are inhaled remove from contaminated area.
· Lay patient down. Keep warm and rested.
· Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
· Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
· Transport to hospital, or doctor.

NOTES TO PHYSICIAN

Treat symptomatically.
for intoxication due to Freons/ Halons;
A: Emergency and Supportive Measures
· Maintain an open airway and assist ventilation if necessary
· Treat coma and arrhythmias if they occur. Avoid (adrenaline) epinephrine or other sympathomimetic amines that may precipitate ventricular arrhythmias. Tachyarrhythmias caused by increased myocardial sensitisation may be treated with propranolol, 1-2 mg IV or esmolol 25-100 microgm/kg/min IV.
· Monitor the ECG for 4-6 hours
B: Specific drugs and antidotes:
There is no specific antidote
C: Decontamination
· Inhalation; remove victim from exposure, and give supplemental oxygen if available.
· Ingestion;
(a) Prehospital: Administer activated charcoal, if available. DO NOT induce vomiting because of rapid absorption and the risk of abrupt onset CNS depression.
(b) Hospital: Administer activated charcoal, although the efficacy of charcoal is unknown. Perform gastric lavage only if the ingestion was very large and recent (less than 30 minutes)
D: Enhanced elimination:
There is no documented efficacy for diuresis, haemodialysis, haemoperfusion, or repeat -dose charcoal.
POISONING and DRUG OVERDOSE, Californian Poison Control System Ed. Kent R Olson; 3rd Edition.
DO NOT administer sympathomimetic drugs as they may cause ventricular arrhythmias.
For poisons (where specific treatment regime is absent):

BASIC TREATMENT

· Establish a patent airway with suction where necessary.
· Watch for signs of respiratory insufficiency and assist ventilation as necessary.
· Administer oxygen by non-rebreather mask at 10 to 15 L/min.
· Monitor and treat, where necessary, for pulmonary oedema .
· Monitor and treat, where necessary, for shock.
· Anticipate seizures .
· DO NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.

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ADVANCED TREATMENT

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- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

BRONSTEIN, A.C. and CURRANCE, P.L.
EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.
Chloroform concentrations may be determined in blood.
Treat irritation symptomatically.
Oral Management:
Chloroform is radiopaque and X-rays confirm ingestion.
DO NOT INDUCE EMESIS because of the rapid onset of CNS depression and the risk of aspiration.
Consider gastric lavage within 1 hour of ingestion because of very rapid absorption of chloroform (use cuffed ET tube to protect airway)
Contact a poisons information service for further guidance on gut decontamination.
Systematic Management.
All patients initially require at least 24 hours observation with ECG monitoring.
Patients should be kept at complete bedrest, the use of stimulants (including adrenaline and noradrenaline) should be avoided because of the risk of sensitisation of the myocardium.
In symptomatic patients the hepatic and renal function should be monitored for at least 3-days post-exposure.
Chest X-rays will be necessary to monitor development of respiratory complications.
Chloroform depletes glutathione stores; N-acetylcysteine (used in the treatment of paracetamol overdose) has been suggested as a possible antidote for hepatotoxic organic solvents (success in carbon tetrachloride intoxications has been reported).

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.

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- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

FIRE/EXPLOSION HAZARD

- Non combustible.
- Not considered a significant fire risk, however containers may burn.

Decomposition may produce toxic fumes of: carbon dioxide (CO_2), hydrogen chloride, phosgene, other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

FIRE INCOMPATIBILITY

Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Personal Protective Equipment

Gloves, boots (chemical resistant).
Breathing apparatus.

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS

- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labelled container for waste disposal.

MAJOR SPILLS

Chemical Class: aliphatics, halogenated

For release onto land: recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
LAND SPILL - SMALL				
cross- linked polymer - particulate	1	shovel	shovel	R, W, SS
cross- linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
wood fiber - pillow	2	throw	pitchfork	R, P, DGC, RT

continued...

treated wood fibre - particulate	2	shovel	shovel	R, W, DGC
sorbent clay - particulate	3	shovel	shovel	R, I, P
foamed glass - pillow	3	throw	pitchfork	R, P, DGC, RT

LAND SPILL - MEDIUM

cross- linked polymer - particulate	1	blower	skiploader	R, W, SS
cross- linked polymer - pillow	2	throw	skiploader	R, DGC, RT
sorbent clay - particulate	3	blower	skiploader	R, I, P
polypropylene - particulate	3	blower	skiploader	W, SS, DGC
foamed glass - pillow	3	throw	skiploader	R, P, DGC, RT
expanded mineral - particulate	4	blower	skiploader	R, I, W, P, DGC

Legend
DGC: Not effective where ground cover is dense
R; Not reusable
I: Not incinerable
P: Effectiveness reduced when rainy
RT:Not effective where terrain is rugged
SS: Not for use within environmentally sensitive sites
W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;
R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988.

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by all means available, spillage from entering drains or water courses.
- Consider evacuation (or protect in place).
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapour.
- Contain or absorb spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)
The maximum airborne concentration below which it is believed that nearly all individuals could be exposed

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for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:
chloroform 5000 ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:
chloroform 50 ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:
chloroform 2 ppm

The threshold concentration below which most people will experience no appreciable risk of health effects:
chloroform 2 ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+)	>= 0.1%	Toxic (T)	>= 3.0%
R50	>= 0.25%	Corrosive (C)	>= 5.0%
R51	>= 2.5%		
else	>= 10%		

where percentage is percentage of ingredient found in the mixture

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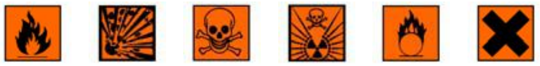
SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



\+ X + X 0 +

+: May be stored together
O: May be stored together with specific preventions
X: Must not be stored together

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- DO NOT allow material to contact humans, exposed food or food utensils.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re

continued...

-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

DO NOT allow clothing wet with material to stay in contact with skin.

SUITABLE CONTAINER

DO NOT use aluminium or galvanised containers.
- Lined metal can, lined metal pail/ can.
- Plastic pail.
- Polyliner drum.
- Packing as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY

Segregate from:
- powdered metals such as aluminium, zinc and
- alkali metals such as sodium, potassium and lithium.

May attack, soften or dissolve rubber, many plastics, paints and coatings.
Avoid magnesium, aluminium and their alloys, brass and steel.
Avoid reaction with oxidising agents.
Segregate from acetone, strong alkali, nitrogen tetroxide, fluorine, metals (Al, K, Li, Mg, Na, NaK alloy), potassium tert-butoxide, methanol, sodium methoxide, disilane, amd triisopropylphosphine.
Also reacts violently with (acetone + a base), (perchloric acid + phosphorous pentoxide), (KOH + methanol) and (NaOH + methanol).

STORAGE REQUIREMENTS
- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records

• chloroform: CAS:67- 66- 3 CAS:8013- 54- 5

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
chloroform		500

ODOUR SAFETY FACTOR (OSF)

OSF=0.024 (CHLOROFORM)

Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.

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The Odour Safety Factor (OSF) is defined as:
OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm
Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV- TWA for example) is being reached, even when distracted by working activities
B	26- 550	As " A" for 50- 90% of persons being distracted
C	1- 26	As " A" for less than 50% of persons being distracted
D	0.18- 1	10- 50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As " D" for less than 10% of persons aware of being tested

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MATERIAL DATA

Odour Threshold Value: 133-276 ppm (detection)
NOTE: Detector tubes for chloroform, measuring in excess of 2 ppm, are commercially available.
The recommendation for TLV-TWA takes into account the reported carcinogenicity and embryotoxicity of chloroform and is thought to protective against liver and kidney cancers and necrosis, cardiac arrhythmias, CNS depression and foetal toxicity and teratogenicity.

PERSONAL PROTECTION




EYE

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be

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removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.

OTHER

- Overalls.
- Eyewash unit.
- Barrier cream.
- Skin cleansing cream.

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
" Forsberg Clothing Performance Index" .
The effect(s) of the following substance(s) are taken into account in the computer- generated selection: chloroform

Protective Material:

PE/EVAL/PE	A
PVA	A
TEFLON	A
VITON	B

A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half- face Respirator	Full- Face Respirator
1000	10	A- AUS	-
1000	50	-	A- AUS
5000	50	Airline *	-
5000	100	-	A- 2
10000	100	-	A- 3
	100+		Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

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For further information consult your
Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.
An approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25- 0.5 m/s (50- 100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5- 1 m/s (100- 200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1- 2.5 m/s (200- 500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5- 10 m/s (500- 2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood- local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

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Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Clear, colourless, very volatile liquid with characteristic heavy, "sweetish" ethereal odour and sweet taste.
Viscosity is 0.56 mPa sec @ 20 C.
Slightly soluble in water (1:200). Mixes with alcohol, benzene, ether, petroleum ether, carbon tetrachloride, carbon disulfide, and oils.

PHYSICAL PROPERTIES

Liquid.
Does not mix with water.
Sinks in water.

Molecular Weight: 119.37
Melting Range (℃): - 63.5
Solubility in water (g/L): Immiscible
pH (1% solution): Not applicable
Volatile Component (%vol): 100
Relative Vapour Density (air=1): 4.13
Lower Explosive Limit (%): Not applicable
Autoignition Temp (℃): None
State: Liquid

Boiling Range (℃): 60- 62
Specific Gravity (water=1): 1.489 @ 20 C
pH (as supplied): Not applicable
Vapour Pressure (kPa): 21.2 @ 20 C
Evaporation Rate: Not available
Flash Point (℃): Not Applicable
Upper Explosive Limit (%): Not applicable
Decomposition Temp (℃): Not Available
Viscosity: Not Available

log Kow (Prager 1995): 1.97
log Kow (Sangster 1997): 1.97
log Kow: 1.97

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from

continued...

respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin).
Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved.
Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

EYE

Limited evidence or practical experience suggests, that the material may cause moderate eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Repeated or prolonged exposure may cause moderate inflammation (similar to windburn) characterised by a temporary redness of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.

SKIN

Skin contact with the material may produce serious damage to the health of the individual ; systemic effects may result following absorption.
The material produces mild skin irritation; evidence exists, or practical experience predicts, that the material either

- produces mild inflammation of the skin in a substantial number of individuals following direct contact, and/or
- produces significant, but mild, inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period.

Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.
Skin contact is not thought to produce harmful health effects (as classified under EC Directives using animal models). Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions. Good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.
Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.

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INHALED

Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.
The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of vapours, fumes or aerosols, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.
Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.
Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved.

CHRONIC HEALTH EFFECTS

On the basis, primarily, of animal experiments, the material may be regarded as carcinogenic to humans. At least one classification body considers that there is sufficient evidence to provide a strong presumption that human exposure to the material may result in cancer on the basis of:
- appropriate long-term animal studies
- other relevant information.

On the basis, primarily, of animal experiments, the material may be regarded as carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to the material may result in cancer on the basis of:
- appropriate long-term animal studies
- other relevant information.

Serious damage (clear functional disturbance or morphological change which may have toxicological significance) is likely to be caused by repeated or prolonged exposure. As a rule the material produces, or contains a substance which produces severe lesions. Such damage may become apparent following direct application in subchronic (90 day) toxicity studies or following sub-acute (28 day) or chronic (two-year) toxicity tests.
There is some evidence that human exposure to the material may result in developmental toxicity. This evidence is based on animal studies where effects have been observed in the absence of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not secondary non-specific consequences of the other toxic effects.
Chronic exposure may produce dizziness, fatigue, drowsiness, memory impairment, increased dreams, anorexia and palpitations. Slight liver damage may occur producing higher concentrations of serum prealbumin and transferrin levels. Neurobehavioural testing shows dose-related negative changes and increased scores in passive mood states. Chronic ingestion of 1.6-2.6 g of chloroform daily for 10 years produced hepatitis and nephrosis. Chronic abuse of chloroform may induce psychotic behaviour.
Repeated exposure to 77-237 ppm has caused lassitude, dullness, urinary frequency, and gastrointestinal disturbances. Other symptoms include dry mouth, thirst, malaise, anorexia, headache, depression, confusion, weakness, blurred vision, paresthesias, loss of sense of balance, memory loss, tremors, anemia, kidney damage, and fatty degeneration of the liver.
Repeated ingestion may cause liver and kidney damage.
Chloroform is not strongly teratogenic but is embryotoxic. Exposure by rats to chloroform (7 hours/day on days 6 through to 15 of gestation) caused an apparent decrease in conception rate and high incidence of foetal resorption (300 ppm), retarded foetal development (30 ppm), decreased foetal body measurements (30 ppm), and a low incidence of acaudate foetuses with imperforate anuses (100 ppm).
When administered by gavage (in corn oil), the chloroform induced

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hepatocellular carcinomas in mice of both sexes. It also induced increased incidences of kidney epithelial tumors when administered by the same route. When administered orally (in olive oil), chloroform produced hepatomas and cirrhosis in female mice. When administered orally in drinking water, chloroform induced increased incidences of renal tubular cell adenomas and/or adenocarcinomas in male rats, but no renal or hepatic tumors were induced in male or female mice.
A further study reports the development of hepatic adenofibrosis in rats of both sexes and neoplastic nodules in females when chloroform was administered in the drinking water. Several epidemiological and ecological studies indicate that there is an association between cancer of the large intestine, rectum, and/or urinary bladder and the constituents of chlorinated water.

TOXICITY AND IRRITATION

TOXICITY	IRRITATION
Oral (rat) LD50: 800 mg/kg	Skin (rabbit):10 mg/24h(open)- Mild
Oral (human) LDLo: 140 mg/kg	Skin (rabbit):500 mg/24h - Mild
Unknown (route) human: LDLo 546 mg/kg	Eye (rabbit): 148 mg
Inhalation (human) LCLo: 25000 ppm/5 m	Eye (rabbit):20 mg/24h - Moderate
Inhalation (rat) LCLo: 8000 ppm/4 h	
Inhalation (human) TCLo: 10 mg/m^3/1 y	
Inhalation (human) TCLo: 5000 mg/m^3/7 m	

WARNING: This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.
Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen [National Toxicology Program: U.S. Dep. of Health & Human Services 2002].

Section 12 - ECOLOGICAL INFORMATION

Hazardous Air Pollutant:	Yes
Fish LC50 (96hr.) (mg/l):	81.5
Daphnia magna EC50 (48hr.) (mg/l):	28.9
Algae IC50 (72hr.) (mg/l):	1.85
log Kow (Prager 1995):	1.97
log Kow (Sangster 1997):	1.97
log Pow (Verschueren 1983):	1.97
Half- life Soil - High (hours):	4320
Half- life Soil - Low (hours):	672
Half- life Air - High (hours):	6231
Half- life Air - Low (hours):	623
Half- life Surface water - High (hours):	4320
Half- life Surface water - Low (hours):	672
Half- life Ground water - High (hours):	43200
Half- life Ground water - Low (hours):	1344
Aqueous biodegradation - Aerobic - High (hours):	4320
Aqueous biodegradation - Aerobic - Low (hours):	672
Aqueous biodegradation - Anaerobic - High (hours):	672
Aqueous biodegradation - Anaerobic - Low (hours):	168
Aqueous biodegradation - Removal secondary treatment - High (hours):	96%
Photolysis maximum light absorption - High (nano- m):	296.3
Photolysis maximum light absorption - Low (nano- m):	220.9
Photooxidation half- life water - High (hours):	2.80E+07
Photooxidation half- life water - Low (hours):	6.90E+05

continued...

Photooxidation half- life air - High (hours):	6231
Photooxidation half- life air - Low (hours):	623
First order hydrolysis half- life (hours):	3500

DO NOT discharge into sewer or waterways.
log Kow: 1.97
Koc: 34
Half-life (hr) air: 1920
Half-life (hr) H2O surface water: 28-744
Henry's atm m^3 /mol: 4.35E-03
BOD 5 if unstated: 0.02
ThOD: 0.33,1.346
BCF: 1.9-10.35
Releases to water will generally evaporate to atmosphere.
Releases to atmosphere may be transported over long distances and will photo-oxidise (half-life 80 days).
Spills and releases on land will evaporate quickly or, due to poor adsorption to soil, leach into ground water where they persist for long periods. Chloroform is not expected to concentrate in the food chain.
Drinking Water Standard:
hydrocarbon total: 10 ug/l (UK max.)
chloroform: 200 ug/l (WHO guideline)
Soil Guidelines: Dutch criteria:
0.001 mg/kg (target)
10 mg/kg (intervention)
Air Quality standards: none available.

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Authority for disposal.
- Bury or incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorised landfill.
- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.

Otherwise:

- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

WASTE DISPOSAL PROCEDURES

- Wear PVA or Viton gloves, eye protection and protective clothing to control personal contact with chloroform [Armour 1996]. Recycle the contents by distillation in a well ventilated area. Otherwise place the waste in a halogenated solvent disposal container for incineration. Dissolve the compound in a non chlorinated flammable solvent and incinerate in a furnace equipped with
an afterburner and scrubber [Armour 1996].

SPILLAGE DISPOSAL

- Clear area of personnel. Wear breathing apparatus, eye protection and

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protective clothing to control personal contact. Contain and cover the spill
with a 1:1:1 mixture by weight of sodium carbonate or calcium carbonate,
calcium
bentonite and sand. Scoop the absorbed chloroform mixture into a container and
label for incineration, in a furnace equipped with an afterburner and scrubber
[Armour 1996].

Section 14 - TRANSPORTATION INFORMATION

Labels Required: TOXIC
HAZCHEM: 2Z

UNDG:

Dangerous Goods Class:	6.1	Subrisk:	None
UN Number:	1888	Packing Group:	III

Shipping Name:CHLOROFORM

Air Transport IATA:

ICAO/IATA Class:	6.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1888	Packing Group:	III
ERG Code:	6A		

Shipping name:CHLOROFORM

Maritime Transport IMDG:

IMDG Class:	6.1	IMDG Subrisk:	None
UN Number:	1888	Packing Group:	III
EMS Number:	F- A, S- A		

Shipping name:CHLOROFORM

Section 15 - REGULATORY INFORMATION

REGULATIONS

chloroform (CAS: 67-66-3) is found on the following regulatory lists;
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk
International Agency for Research on Cancer (IARC) Carcinogens
OECD Representative List of High Production Volume (HPV) Chemicals
WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water

No data available for chloroform as CAS: 8013-54-5.

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Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
chloroform	67- 66- 3, 8013- 54- 5

REPRODUCTIVE HEALTH GUIDELINES

Established occupational exposure limits frequently do not take into consideration reproductive end points that are clearly below the thresholds for other toxic effects. Occupational reproductive guidelines (ORGs) have been suggested as an additional standard. These have been established after a literature search for reproductive no-observed-adverse effect-level (NOAEL) and the lowest-observed-adverse-effect-level (LOAEL). In addition the US EPA's procedures for risk assessment for hazard identification and dose-response assessment as applied by NIOSH were used in the creation of such limits. Uncertainty factors (UFs) have also been incorporated.

Ingredient	ORG	UF	Endpoint	CR	Adeq TLV
chloroform	2.6 mg/m3	100	D	200	-

These exposure guidelines have been derived from a screening level of risk assessment and should not be construed as unequivocally safe limits. ORGS represent an 8-hour time-weighted average unless specified otherwise.
CR = Cancer Risk/10000; UF = Uncertainty factor:
TLV believed to be adequate to protect reproductive health:
LOD: Limit of detection
Toxic endpoints have also been identified as:
D = Developmental; R = Reproductive; TC = Transplacental carcinogen
Jankovic J., Drake F.: A Screening Method for Occupational Reproductive
American Industrial Hygiene Association Journal 57: 641-649 (1996).

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